

US EPA ARCHIVE DOCUMENT

# Nooksack ESA Salmonid life history exposures to climate change effects Ned Currence

Nooksack Tribe

Jan. 23, 2013

# Spring Chinook

- Migrate and hold in summer
  - Temperature related diseases, reduced fecundity
  - Thermal migration barriers? Passage flows?
- Spawn mid-summer to early fall
  - Low Q initially followed by greater floods may affect spatial distribution as well as set up for redd loss
- Incubate mid-summer to late winter
  - Reduced fecundity, greater flood redd losses
- Some year around rearing ( $>T$ ,  $<\text{low flow}$ ,  $>\text{high flow}$ )

# SPRING CHINOOK

River Entry

Upstream Migration/ Holding

Spawning

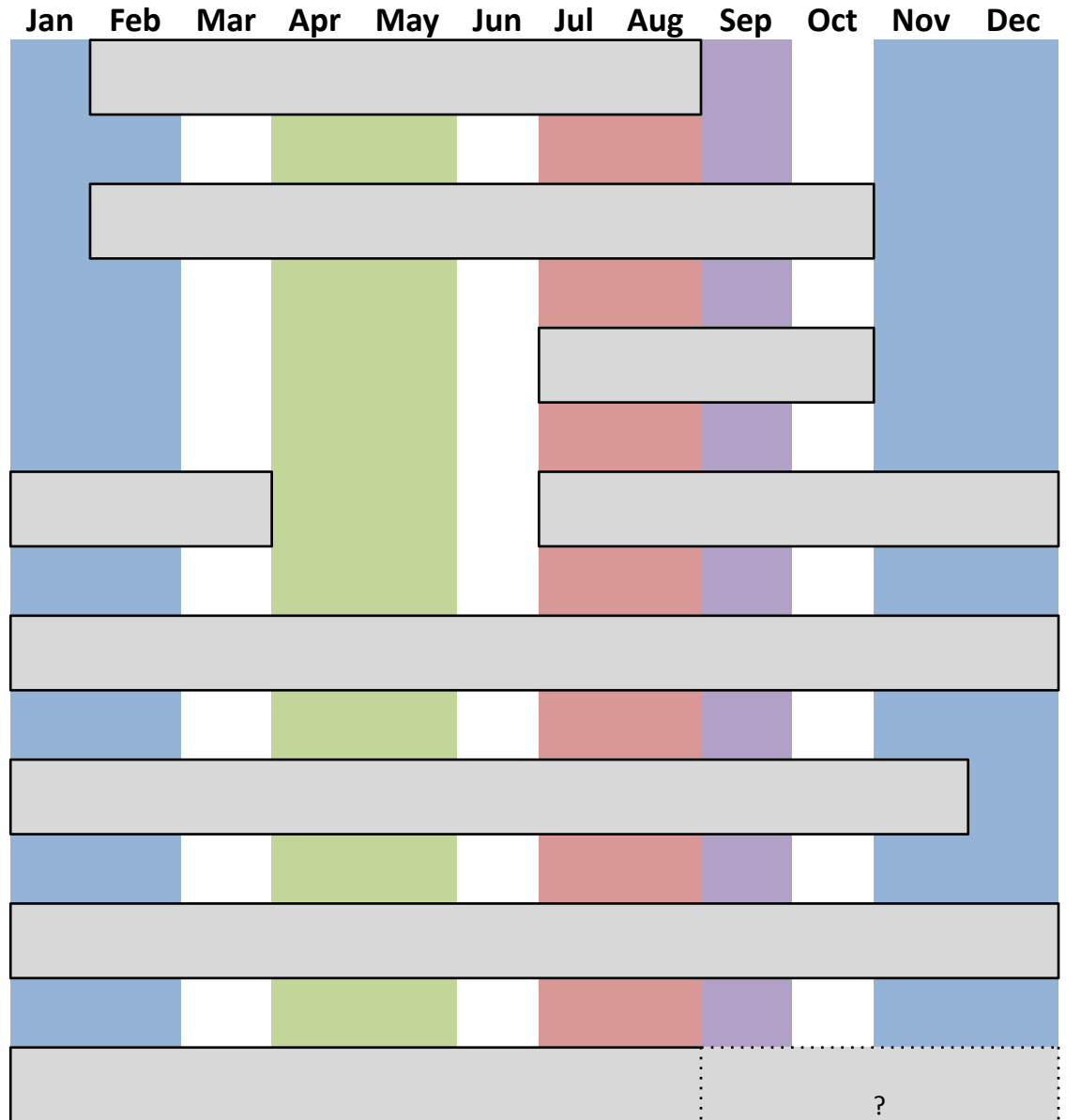
Intragravel Development

Age-0 rearing

Age-0 outmigration

Age-1+ rearing

Age-1+ outmigration



# S Fk Summer Steelhead

- Migrate above Sylvesters Falls and 30 mile barrier in summer (lower flow, higher temps)
- Less impact on spawning and incubation due to late winter timing
- Low summer flow, high winter flow and temperature effects on year around rearing

# SUMMER STEELHEAD

Upstream Migration

Holding

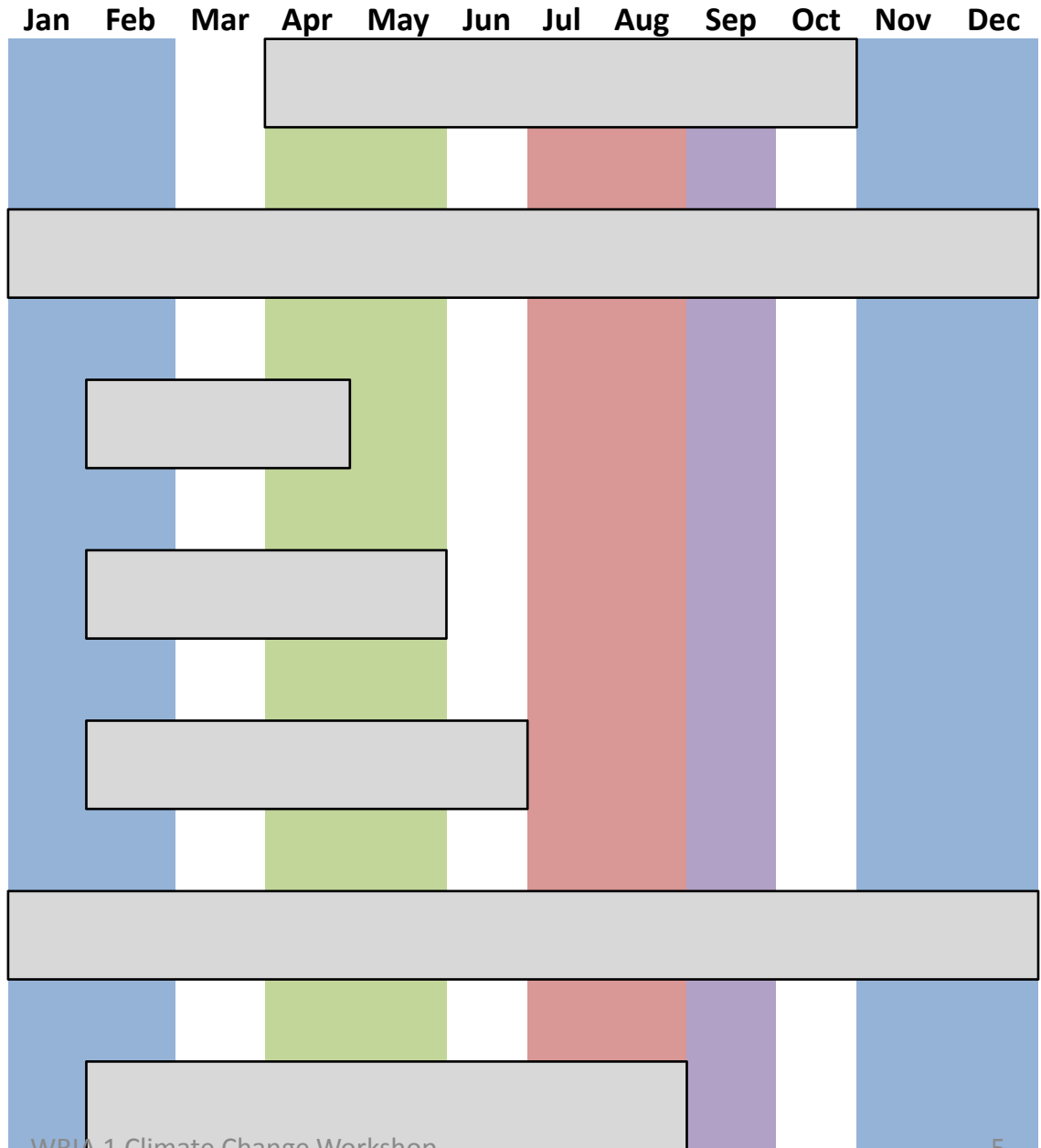
Spawning

Adult Outmigration

Intragravel Development

Juvenile Rearing

Juvenile Outmigration



Currence:

Salmon/ClimateChange

WRIA 1 Climate Change Workshop

# Winter run steelhead

- Late winter to early July spawning (earlier in lower watershed, late high in watershed) so early spring snow melt could affect migrations (Hutchinson Creek), and spatial distribution
- Lower summer flow, higher winter flow impacts on year around rearing
- Many lowland areas have inadequate summer discharge
- Higher temps could reduce fecundity during incubation, and adversely affect summer rearing

# WINTER STEELHEAD

Upstream Migration

Holding

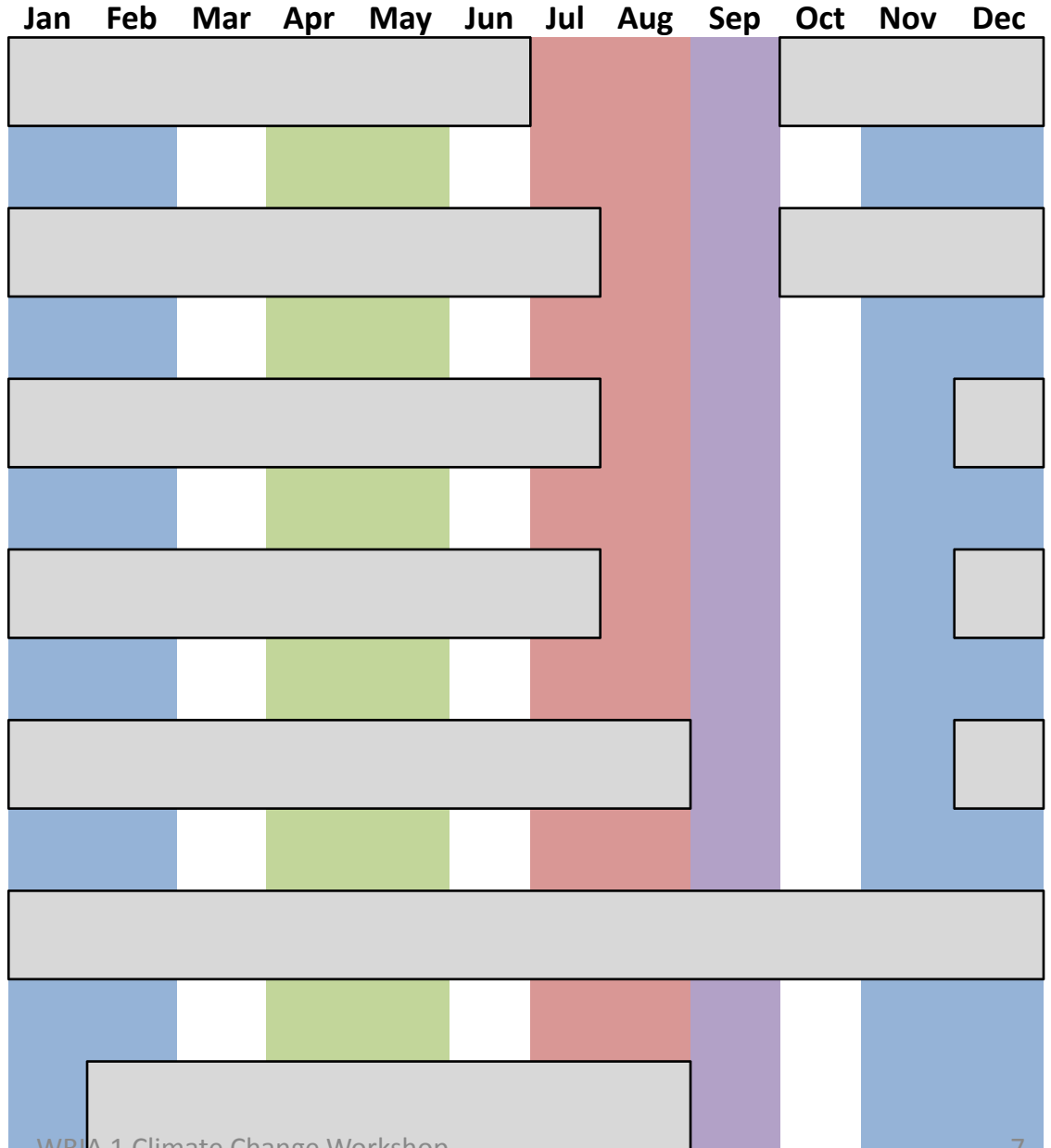
Spawning

Adult Outmigration

Intragravel Development

Juvenile Rearing

Juvenile Outmigration





# Bull Trout

- Further shrink suitable habitat (early accounts suggest greater former range)
- Summer migration exposes to low flow/early snowmelt impacts, possible thermal and physical barrier challenges, and reduced fecundity
- Impaired migration corridors pose risks for anadromous adults and sub-adults including:
  - Reduced fecundity from Temperatures and Temperature-related diseases, reduced prey base
- Extended rearing exposes to  $>T$  and changes in  $Q$
- Spawn timing may shift later (48-49 deg. F)

# BULL TROUT

Upstream Migration

Subadult Upstream Migration

Subadult Overwinter Holding

Holding

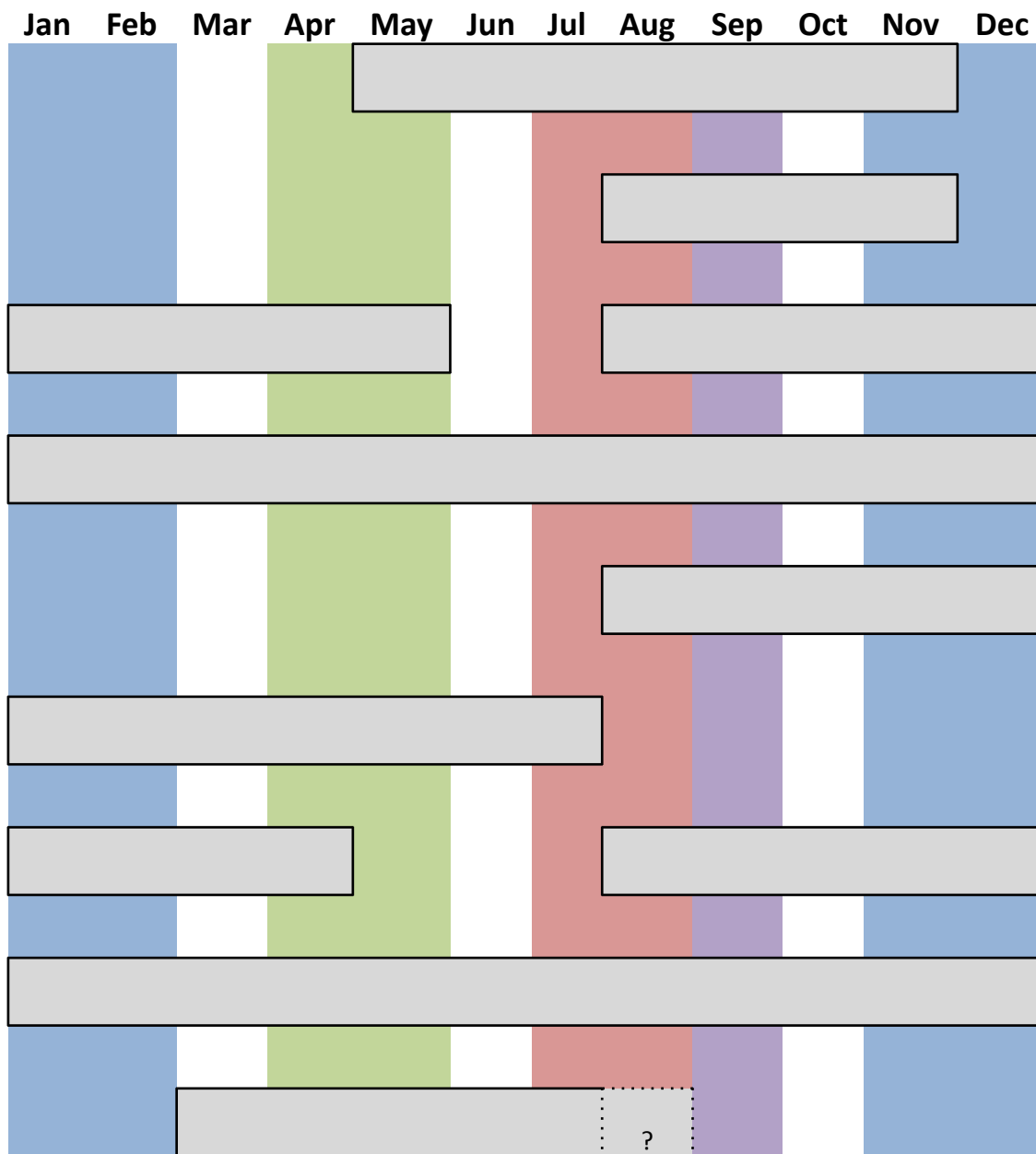
Spawning

Adult Outmigration

Intragravel Development

Juvenile Rearing

Juvenile Outmigration



# Common Themes

- All three ESA salmonids have:
  - Summer (and snow melt) migration and holding
  - At least some year around juvenile rearing
- Chinook and winter steelhead have summer incubation
- Summer steelhead and bull trout migrate above very challenging barriers in S Fk, winter runs in Hutchinson Creek

# Current South Fork

- Is already highly temperature impaired
- Lacks good holding pools with cover
- Has low late summer and early fall discharge due to lack of glaciers
- Lacks abundant LWD and has relatively young riparian stands
- Lower S Fk lacks riparian, lacks LWD and holding habitats, and is warm - tubers love it!